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# Sodium Meta-Bisulfite and Kylage 1/ as Preservatives in High Moisture Hay-Crop Silage 2/

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The increasing use of ensiling as a method of hay-crop preservation has stimulated interest in procedures that might increase the quantitative or qualatative effectiveness of the method. Methods that show promise of reducing the usual storage losses or improving the odor and quality of the silage, particularly that made from crops high in moisture, are all worthy of consideration. Rapid acidification of the forage by some added material has been one general approach receiving considerable attention.

The use of sodium meta-bisulfite as an acidifying agent for wilted silage made in 1952 at the Agricultural Research Center, Beltsville, Maryland, showed little practical benefit. However, it seemed likely that this or similar acidifying materials would be of more value in improving odor and decreasing losses in high moisture silages. Accordingly sodium meta-bisulfite and Kylage, a patented product similar to one used extensively in Germany, were used in high moisture forage from the 1953 crop.

## Experimental Procedure

A first cutting crop mixture consisting mainly of Ladino Clover and Orchard Grass was harvested without wilting and stored simultaneously in three concrete stave silos (10' x 25'). The forage in the No. 1 silo was stored without treatment, that in the No. 2 silo was treated with 8.2 lbs. of sodium meta-bisulfite per ton and that in the No. 3 silo was treated with 5.1 lbs. of Kylage per ton. These materials were added through a modified fertilizer hopper as the forage entered the blower.

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1/ The Kylage used in this experiment was quite similar in composition to a German product sold as Kofa, while the Kylage being distributed in 1954 contains exactly the same ingredients as Kofa.

2/ Preliminary summary of data. Paper presented at the annual meeting of the American Dairy Science Association, State College, Pa., June 21-24, 1954.

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The forage was weighed, sampled and analyzed previous to storage and as it was removed for feeding. Weighing and sampling of the seepage was also planned. However, before filling was completed it became apparent that this could not be accomplished because of the tremendous volume of seepage that flowed from several points on the silo as well as through the regular floor drain.

The silos were opened following a storage period of 198 days and fed to 18 milking cows in an 80-day feeding trial. Two phases only of the originally planned 120-day Latin Square Design feeding trial were completed because of insufficient silage. Silage fed to the limit of appetite, supplemented by a simple grain mixture fed according to production, comprised the entire ration.

## Results

The appearance and odor of the three silages was distinctly different. Much of the untreated silage was dark in color and had a strong odor. The odor varied considerably with location in the silo, that in the bottom portion of the silo being more pleasant. The bisulfite treated silage was lighter in color and possessed a characteristic but pleasant odor. The Kylage treated silage was intermediate in color and possessed its own characteristic pleasant odor.

The composition of the fresh and ensiled silages is presented in Table 1. Judging by these analyses the bisulfite treated silage was of higher quality than the other two. It was characterized by a lower crude fiber and higher N.F.E. content as well as a lower ammoniacal nitrogen content as evidence of less protein degradation. Quality was similarly improved by the addition of Kylage but to a lesser degree.

The amounts of the various constituents preserved for feeding, as compared to the amounts stored, are presented in Table 1. Low preservation rates characterized all three silages. However, the addition of bisulfite and to a lesser extent Kylage, were of benefit in increasing preservation efficiency. The increased preservation of dry matter is probably of greatest practical significance. The percentages of stored dry matter preserved, exclusive of top spoilage, were: untreated, 74.4; bisulfite treated, 80.7; and Kylage treated, 77.0. These losses can largely be attributed to fermentation and seepage. It is important to note that more than 90 percent of the stored dry matter was preserved in a similar 1952 crop which was wilted to a dry matter content of about 30 percent.

Results of the feeding trial are presented in Table 2. All groups failed to maintain the live weight, this being most pronounced in the groups fed untreated silage. Declines in milk production did not appear to be significantly different between the silages. The somewhat higher palatability of the bisulfite silage was rather consistent throughout the trial. The untreated, although usually the least palatable, showed considerable variation, that in the lower portion of the silo being more palatable than that from the upper portion. The Kylage treated silage maintained an intermediate position with respect to palatability during most of the feeding trial.

Table 1.- Average Composition of Silages and Percentages of Stored Nutrients Preserved for Feeding

| | Composition 1/ As Stored | | | Composition 1/ As Removed | | | Percent of Stored Nutrients Preserved for Feeding | | |
|---|---|---|---|---|---|---|---|---|---|
| | Untreated | Bisulfite | Kylage | Untreated | Bisulfite | Kylage | Untreated | Bisulfite | Kylage |
| Dry Matter | 19.4 | 19.9 | 20.6 | 22.9 | 24.9 | 23.9 | 74.4 | 80.7 | 77.0 |
| Crude Protein | 18.0 | 17.6 | 17.2 | 19.2 | 17.5 | 19.1 | 79.5 | 80.5 | 85.7 |
| Ether Extract | 2.6 | 2.6 | 2.7 | 3.0 | 4.0 | 4.1 | 85.2 | 122.4 | 117.4 |
| Crude Fiber | 26.0 | 26.6 | 25.5 | 30.7 | 28.9 | 29.9 | 87.7 | 87.8 | 90.3 |
| N.F.E. | 44.5 | 42.2 | 44.5 | 37.4 | 39.3 | 37.7 | 62.5 | 75.6 | 65.2 |
| Ash | 8.9 | 10.4 | 10.1 | 9.7 | 10.1 | 9.3 | 81.5 | 73.6 | 70.4 |
| Sugar | 5.4 | 6.1 | 5.6 | 0.2 | 0.8 | 0.3 | 2.8 | 10.9 | 3.4 |
| Ammon. Nit | 0.7 | 0.7 | 0.6 | 4.7 | 1.9 | 2.7 | 481.7 | 211.8 | 318.9 |
| Carotene | 171 | 163 | 154 | 145 | 175 | 134 | 63.2 | 86.5 | 67.0 |
| pH | 6.12 | 6.05 | 6.12 | 4.98 | 4.07 | 4.52 | | | |

1/ Carotene expressed as ug/gram of dry matter, all other constituents expressed as percentage of dry matter.

Differences in dry matter digestibility, as measured in a digestion trial, were small. Bisulfite treated silage displayed a slightly higher percentage of digestible dry matter.

Table 2.- Results of Feeding Trial

| Items Compared | | Untreated | Bisulfite | Kylage |
|---|---|---|---|---|
| Live weight of cows: | | | | |
| Initial weight per cow | pounds | 1050.1 | 1014.2 | 996.2 |
| Average weight per cow | " | 1035.8 | 1013.3 | 987.4 |
| Average gain per cow per day | " | -.690 | -.067 | -.380 |
| Milk production 1/: | | | | |
| Initial per cow per day | " | 34.96 | 34.03 | 35.61 |
| Average per cow per day | " | 31.80 | 31.57 | 32.88 |
| 30 day decline | " | 4.51 | 3.92 | 4.19 |
| | percent | 12.9 | 11.5 | 11.8 |
| Feed dry matter consumed per cow per day: | | | | |
| Silage | pounds | 15.22 | 18.84 | 17.75 |
| Concentrates | " | 8.48 | 8.09 | 8.25 |
| Total | " | 23.70 | 26.93 | 26.00 |
| Feed dry matter consumed per 100 pounds of live weight per day: | | | | |
| Silage | pounds | 1.469 | 1.859 | 1.798 |
| Concentrates | " | .819 | .798 | .836 |
| Total | " | 2.288 | 2.657 | 2.634 |
| Feed dry matter consumed per 100 pounds of milk produced 1/: | | | | |
| Silage | pounds | 47.86 | 59.68 | 53.98 |
| Concentrates | " | 26.67 | 25.63 | 25.09 |
| Total | " | 74.53 | 85.31 | 79.07 |
| Ratio - grain to milk | | 1:3.8 | 1:3.9 | 1:4.0 |
| Digestibility of dry matter | percent | 52.1 | 53.9 | 52.1 |

1/ 4 percent fat corrected milk.

## Summary and Conclusion

The results of this experiment demonstrated that the quality of silage made from high moisture forage and the efficiency of preservation can be improved by the addition of sodium meta-bisulfite and, to a lesser extent, by the addition of Kylage. The palatability of such silage can also be increased by these treatments. The results also indicated that even with the benefit of these treatments the silage was less efficiently preserved and less palatable than similar silage made with no treatment other than wilting.